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**10CFR 50.73**

2CAN091208

September 27, 2012

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555-0001

Subject: Licensee Event Report 50-368/2012-001-00  
Automatic Reactor Trip and Emergency Feedwater Actuation  
Arkansas Nuclear One – Unit 2  
Docket No. 50-368  
License No. NPF-6

Dear Sir or Madam:

Pursuant to the requirements of 10CFR 50.73(a)(2)(iv)(A), attached is the subject Licensee Event Report concerning an automatic reactor trip on August 08, 2012 with a subsequent Emergency Feedwater actuation.

There are no new commitments contained in this submittal. Should you have any questions concerning this issue, please contact Stephenie Pyle, Licensing Manager, at 479-858-4704.

Sincerely,

***Original signed by Christopher J. Schwarz***

CJS/slc

Attachment: Licensee Event Report 50-368/2012-001-00

cc: Mr. Elmo Collins  
Regional Administrator  
U. S. Nuclear Regulatory Commission  
Region IV  
1600 East Lamar Boulevard  
Arlington, TX 76011-4511

NRC Senior Resident Inspector  
Arkansas Nuclear One  
P.O. Box 310  
London, AR 72847

Institute of Nuclear Power Operations  
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**LICENSEE EVENT REPORT (LER)**(See reverse for required number of  
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to [infocollects.resource@nrc.gov](mailto:infocollects.resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

**1. FACILITY NAME**

Arkansas Nuclear One – Unit 2

**2. DOCKET NUMBER**

05000368

**3. PAGE**

1 of 4

**4. TITLE** Degraded Condenser Vacuum Due to the Failure of Condenser Vacuum Pump Solenoid Valves Results in a Main Turbine Trip and Subsequent Automatic Reactor Trip**5. EVENT DATE**MONTH DAY YEAR  
08 08 2012**6. LER NUMBER**YEAR SEQUENTIAL  
NUMBER REV  
NO.  
2012 - 001 - 00**7. REPORT DATE**MONTH DAY YEAR  
09 27 2012**8. OTHER FACILITIES INVOLVED**FACILITY NAME DOCKET NUMBER  
FACILITY NAME DOCKET NUMBER**9. OPERATING MODE**

1

**10. POWER LEVEL**

100

**11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)**

- |   |   |  |  |
|---|---|--|--|
| <input type="checkbox"/> 20.2201(b)         | <input type="checkbox"/> 20.2203(a)(3)(i)   | <input type="checkbox"/> 50.73(a)(2)(i)(C)             | <input type="checkbox"/> 50.73(a)(2)(vii)        |
| <input type="checkbox"/> 20.2201(d)         | <input type="checkbox"/> 20.2203(a)(3)(ii)  | <input type="checkbox"/> 50.73(a)(2)(ii)(A)            | <input type="checkbox"/> 50.73(a)(2)(viii)(A)    |
| <input type="checkbox"/> 20.2203(a)(1)      | <input type="checkbox"/> 20.2203(a)(4)      | <input type="checkbox"/> 50.73(a)(2)(ii)(B)            | <input type="checkbox"/> 50.73(a)(2)(viii)(B)    |
| <input type="checkbox"/> 20.2203(a)(2)(i)   | <input type="checkbox"/> 50.36(c)(1)(i)(A)  | <input type="checkbox"/> 50.73(a)(2)(iii)              | <input type="checkbox"/> 50.73(a)(2)(ix)(A)      |
| <input type="checkbox"/> 20.2203(a)(2)(ii)  | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | <input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x)          |
| <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2)        | <input type="checkbox"/> 50.73(a)(2)(v)(A)             | <input type="checkbox"/> 73.71(a)(4)             |
| <input type="checkbox"/> 20.2203(a)(2)(iv)  | <input type="checkbox"/> 50.46(a)(3)(ii)    | <input type="checkbox"/> 50.73(a)(2)(v)(B)             | <input type="checkbox"/> 73.71(a)(5)             |
| <input type="checkbox"/> 20.2203(a)(2)(v)   | <input type="checkbox"/> 50.73(a)(2)(i)(A)  | <input type="checkbox"/> 50.73(a)(2)(v)(C)             | <input type="checkbox"/> OTHER                   |
| <input type="checkbox"/> 20.2203(a)(2)(vi)  | <input type="checkbox"/> 50.73(a)(2)(i)(B)  | <input type="checkbox"/> 50.73(a)(2)(v)(D)             | Specify in Abstract below<br>or in NRC Form 366A |

**12. LICENSEE CONTACT FOR THIS LER**

FACILITY NAME

Stephenie L. Pyle, Licensing Manager

TELEPHONE NUMBER (Include Area Code)

479-858-4704

**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANU- FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU- FACTURER	REPORTABLE TO EPIX
B	SH	2SV-0688	A609	Y	B	SH	2SV-0690	A609	Y

**14. SUPPLEMENTAL REPORT EXPECTED**☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO**15. EXPECTED  
SUBMISSION  
DATE**MONTH DAY YEAR  
N/A N/A N/A

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On August 08, 2012 at 0823 CDT, Arkansas Nuclear One Unit-2 (ANO-2) tripped from approximately one hundred percent power due to degraded main condenser vacuum. The 2C-5B Condenser Vacuum Pump (one of two condenser vacuum pumps) had been secured by taking the control handswitch to pull-to-lock by Operations personnel to perform routine oil level checks. Ambient temperatures were low enough to maintain condenser vacuum with one condenser vacuum pump (2C-5A) in service. When 2C-5B was secured, two solenoid valves failed to reposition the isolation valves on 2C-5B, which resulted in a significant air flow path from atmosphere through the vacuum pump, causing condenser pressure to increase to the main turbine trip setpoint. The main turbine tripped on high turbine exhaust pressure which resulted in an automatic reactor scram due to high reactor coolant system pressurizer pressure. The Emergency Feedwater Actuation System actuated for the "A" Steam Generator due to steam generator water level trending slightly below setpoint. After investigation and corrective maintenance, ANO-2 was reconnected to the electrical grid on August 09, 2012. The root cause investigation determined that the subject solenoid valves were installed in an environment with temperatures in excess of designed temperature ratings. This condition resulted in heat related binding of the solenoid valves and failure to reposition when de-energized. The planned corrective action to preclude recurrence of this root cause will implement a modification to change the solenoid valve location to allow proper heat dissipation.

# LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

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Arkansas Nuclear One – Unit 2	05000368	YEAR	SEQUENTIAL NUMBER	REV. NO.	2 OF 4
		2012	- 001	- 00	

## NARRATIVE

### A. Plant Status

At the time of the subject event, Arkansas Nuclear One Unit-2 (ANO-2) was at approximately 100% power. All structures, systems, and components that were needed to mitigate, reduce the consequences of, or limit the safety implications of the event were available.

### B. Event Description

On August 08, 2012 at 0823 CDT, Arkansas Nuclear One Unit-2 (ANO-2) tripped from approximately one hundred percent power due to degrading main condenser vacuum. The 2C-5B Condenser Vacuum pump [SH] [P] had been secured for oil level checks, with the 2C-5A Condenser Vacuum Pump operating to maintain condenser vacuum. Ambient conditions were such that condenser vacuum was within the capacity of one vacuum pump. Operations placed the 2C-5B handswitch in pull-to-lock to allow a cooldown to ambient conditions for routine oil level checks as recommended by the vendor technical manual.

The ANO-2 Condenser Vacuum System consists of two vacuum pumps designed to maintain vacuum on the two main steam condensers. Each ANO-2 condenser vacuum pump is designed with five air operated valves. There are two suction valves and two air ejector bypass valves piped from the main condensers, and one valve to provide motive air flow to the air ejectors. This motive air path is normally aligned to atmosphere. Normally, when the vacuum pump is secured, one solenoid valve de-energizes to relieve air and close the two suction valves, and one solenoid valve de-energizes to relieve air and close the motive air valve.

During this event, both solenoid valves failed to reposition when the 2C-5B Vacuum Pump was secured, resulting in the two suction valves and the motive air valve (aligned to atmosphere) remaining open, establishing a flowpath from atmosphere through the vacuum pump and into the main condensers. Condenser pressure indication in the control room did not begin to indicate the rising condenser pressure for approximately sixteen to twenty seconds due to the location of the air ingress path in relation to the location of the condenser pressure transmitters. Approximately thirty seconds after 2C-5B was secured, the control room received a high main condenser pressure alarm, at which time 2C-5B was removed from pull-to-lock and restarted. By the time the condenser pressure transmitters sensed the pressure increase and actuated the high condenser pressure alarm, the volume of air that had been drawn into the main condensers was beyond the capacity of the condenser vacuum system to prevent a main turbine trip. Approximately twenty-two seconds after the high condenser pressure alarm was received, the main turbine automatically tripped on high exhaust hood pressure, resulting in a subsequent automatic reactor trip on high pressurizer pressure. Condenser vacuum began to recover approximately eleven seconds after the trip. The Emergency Feedwater Actuation System [BA] actuated for the "A" Steam Generator due to water level trending slightly below setpoint, and the Emergency Feedwater System was used to feed the steam generators until Auxiliary Feedwater was aligned.

After investigation of the event and corrective maintenance on the 2C-5B solenoid valves, ANO-2 was reconnected to the electrical grid on August 09, 2012.

**LICENSEE EVENT REPORT (LER)  
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**C. Event Cause**

The root cause of the event was determined to be a simultaneous failure of the two ASCO model 8342 solenoid valves [SH][SOL] (ANO-2 component numbers 2SV-0688 and 2SV-0690) which were installed in an environment outside of designed temperature limits, resulting in a heat related failure. The vacuum pump solenoid valves are located inside an enclosed cabinet which is mounted as part of the vendor supplied pump skid. The cabinet doors are normally closed and the enclosure is not ventilated to allow heat generated by the solenoids to escape. The vendor tech manual indicates that the solenoid valves were suited for ambient conditions between 32 and 125 degrees F. The internal cabinet temperature near the valve bodies was measured at approximately 150 degrees F, with solenoid coil temperatures well over 200 degrees F. The internal elastomers were not rated for these temperatures and resulted in valve binding or sluggishness when the solenoids were de-energized.

**D. Corrective Actions**

The solenoid valves were replaced prior to plant startup. Future planned corrective action to prevent recurrence of the root cause is expected to include a modification to change the solenoid valve location to allow proper heat dissipation. Additionally, a modification is under consideration that would install a switch or button to verify proper operation of the solenoids and suction valves prior to securing a vacuum pump.

**E. Safety Significance Evaluation**

Systems and components required to shutdown the reactor, maintain safe shutdown conditions, remove residual heat, and control the release of radioactive material were available and performed as required. No safety limits were exceeded and the loss of external load and/or main turbine trip is an analyzed condition listed in ANO-2 Safety Analysis Report. The reactor scram due to high pressurizer pressure as a result of the main turbine trip did not pose any safety risk to the general public, nor create any unanalyzed nuclear, industrial, or radiological safety issues.

**F. Basis For Reportability**

This event is reported pursuant to 10 CFR 50.73(a)(2)(iv)(A): "Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B)." 10 CFR 50.73(a)(2)(iv)(B): "Reactor protection system (RPS) including: reactor scram or reactor trip" and "PWR auxiliary or emergency feedwater system."

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## G. Additional Information

10CFR 50.73(b)(5) states that this report shall contain reference to “any previous similar events at the same plant that are known to the licensee.” NUREG-1022 reporting guidance states that term “previous occurrences” should include previous events or conditions that involved the same underlying concern or reason as this event, such as the same root cause, failure, or sequence of events.

A review of the ANO corrective action program and Licensee Event Reports for the previous three years revealed no relevant similar events.

Energy Industry Identification System (EIIIS) codes and component codes are identified in the text of this report as [XX].